

# 3D technology in fashion: from concept to consumer

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## Abstract

**Purpose** – The purpose of this paper is to show how 3D digital technology can bring value to the fashion industry by analysing the specific benefits it offers along the value chain. Additionally, the authors show some of the challenges ahead identified for both software and fashion firms.

**Design/methodology/approach** – The authors present by means of a case study the experience of an haute couture designer who used 3D digital technology – in collaboration with a recognised 3D software company – for developing his first luxury footwear collection.

**Findings** – The enhancement of creativity and a better communication with suppliers are just some of the benefits identified in the case study from the use of 3D digital technology. In addition, challenges such as the development of a digital culture or the need for technology simplification are drawn from the case.

**Practical implications** – Apart from the benefits and challenges drawn from the case study, which can be useful to practitioners in this industry, the authors also identify the collaboration through which the experience took place as an interesting practice to implement as a previous step of a digital transformation strategy.

**Originality/value** – Despite the growing interest the fashion industry is showing in the use of new digital technologies, academic research on this topic is still scarce. Therefore, the case study presented in this paper adds value to the literature showing how 3D technology can help fashion from concept to consumer.

**Keywords** Fashion industry, Product development, 3D, Digital transformation, 3D digital technology, Haute couture

**Paper type** Case study

## 1. Introduction

During the last decade we have seen how fast digital technology has transformed the media and entertainment industries, but we have started to realise how it is transforming the rest of industries (Westerman *et al.*, 2011). Research on digital transformation has been focused on describing the transformation of these specific industries whose products can be completely digitised, missing the study of digital transformation in industries with physical products (Hanelt *et al.*, 2015), for instance the fashion industry, which is the focus of this paper.

First marked by the penetration of the internet, e-commerce, m-commerce and social media, and more recently by the impact of digital technologies like 3D, Internet of Things, virtual reality or artificial intelligence, the fashion industry is on the way to radically change not only the marketing and relationship with customers (the business front-end) but also the back end operations by achieving more efficiency across the whole value chain (Mullon, 2015). Specifically, 3D digital technology in fashion is seen as a transformative and disruptive technology when compared to the way products are designed and developed nowadays (Court, 2015). Even though, when it comes to its usage, this industry is in an exploratory phase (Reilly, 2014; Choi, 2015) and a lot of technological advancements are still needed (Papahristou and Bilalis, 2016) until it is more generally adopted. It is therefore an emerging area of research where there is still a lack of scholarly information and empirical research (Parker, 2016; Vanderploeg *et al.*, 2017).

Therefore, we aim with this paper to enlarge the lack of literature by providing a real case study that describes the experience of a creative fashion designer using



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3D technology[1] – with the collaboration of a software company. From this experience we expect to answer two main research questions:

- RQ1.* Which are the main benefits the fashion firm can obtain from using 3D technology along the whole process from the creation to the consumer?
- RQ2.* How about the main challenges ahead for both software and fashion firms in order to achieve the democratisation of 3D technology in the fashion industry?

The paper is organised as follows. In the next section, the theoretical background and our contribution are presented. Then, we explain the research methodology followed in the paper. After that, the case study is developed and discussed, and finally, we share our conclusions as well as the limitations and further research.

## 2. Background for research

### 2.1 Digital transformation of the fashion industry

The advancements in digital technologies and their fast adoption during the last few decades have fostered fundamental shifts in a lot of aspects of the social and economic lives (Piccinini *et al.*, 2015; Schwab, 2016). In the business world, different areas are being digitally transformed (Westerman *et al.*, 2011; Fitzgerald *et al.*, 2014), such as the product, the customer relationship and experience, the internal operational processes and the business model or value proposition. In literature we find consensus on the four main emerging digital technologies disrupting business: social and collaborative technologies, data analytics, mobile technologies and smart-embedded devices (Westerman *et al.*, 2011; Fitzgerald *et al.*, 2014). However, in addition to these, other technologies such as cloud-computing services are also considered key technologies for companies' transformation (Bharadwaj *et al.*, 2013; Piccinini *et al.*, 2015), as well as others like 3D technology, cyber-physical systems and virtual reality, which have been identified as core technologies for instance in the digital transformation of manufacturing industry known as Industrie 4.0 (Kagermann *et al.*, 2013; Hermann *et al.*, 2015).

Digital transformation has become a hot topic for all companies worldwide (Westerman *et al.*, 2011). We have already seen how fast digital technology has transformed industries such as media and entertainment, and now we are seeing how it is transforming the rest of industries. Indeed, research until now on digital transformation has been focused on describing the transformation of these specific industries in which the products can be completely digitised (music, movies or newspapers). And, what is missing to date is research on how this digital transformation is affecting other industries which products are mainly physical (Hanelt *et al.*, 2015), for instance the fashion industry.

The fashion industry has been historically quite disconnected from the advancements of technology as it has always been much attached to manual production and other intangible values related to the product. Nevertheless, in the last few decades, mainly due to globalisation trends the industry has experienced an increase in competitive pressure and a shift in consumers' behaviour. This new market environment has motivated the industry to start relying on technology. For instance, in the last report published by McKinsey and Business of Fashion, digitalization was identified as one of the key objectives in the next coming years for this industry to achieve supply chain efficiency (The Business of Fashion and McKinsey, 2016). The use of digital technology in the back end (operations side) of this industry is still in its infancy. Even though fashion companies are already experiencing the implementation of software such as Product Lifecycle Management Software[2] (d'Amico *et al.*, 2013; d'Avolio *et al.*, 2015; Vezzetti *et al.*, 2015), when it comes to digital technologies such as 3D, virtual or augmented reality, these companies are in an exploratory phase and a lot of technological advancements are still needed (Papahristou and Bilalis, 2016).

## 2.2 The use of 3D digital technology in the fashion industry

3D digital technologies such as 3D design software[3] and 3D printing[4] have been used in traditional industries like aerospace and automotive for a long time now, starting their popularity back in the 1980s-1990s. Nowadays, with all the technological advances of the last decades, these technologies have dramatically evolved offering new techniques and capabilities, thanks to which other industries have started to show interest in exploring its use, as it is the case of the fashion industry.

With a focus on this industry, we have found some technical research being conducted in fields such as computer graphics and computer-aided design on how to use this technology to design fashion products, such as garments (Volino *et al.*, 2005; Liu *et al.*, 2010; Spahiu *et al.*, 2014) and footwear (Zequin and Rui, 2010; Leng and Du, 2006). In this sense, we can argue that the degree of innovation and digital transformation in this industry will vary in function of the segment and product category that we are analysing. However, as far as we are concerned, from a business and management perspective it is considered an emerging area of research where there is still a lack of scholarly information (Reilly, 2014; Vanderploeg *et al.*, 2017).

In the practical business side, even though its use is relatively new, 3D digital technology is seen in the fashion industry as a transformative and disruptive technology when compared to the way products are designed and developed nowadays (Court, 2015). In fact, the traditional process of product design and development in this industry is based on an iterative process in which a number of repeated cycles of samples, fittings and design alterations are conducted in order to achieve the initial concept ideas of the designer coming true in the physical final product (Papahristou and Bilalis, 2016). It is a time-consuming and costly process, which depends on the know-how and skills of the designer and the product development team, and it can take up to the 70 per cent of an ordinary product lifecycle (Jefferson *et al.*, 2012; Papachristou and Bilalis, 2015). In addition, problems of communication with factories during this iterative process in a lot of cases lead to inadequate interpretations of the initial design (Papahristou and Bilalis, 2016).

To face these constraints in the process, it has been reported that the adoption of 3D digital technologies during the design and development process can help fashion companies reduce the lead time, as well as the errors in prototypes due to misunderstandings with manufacturers or other actors involved in the chain, and the number of physical samples required (Cepolina, 2011; Vilumsone and Dāboliņa, 2012; Vanderploeg *et al.*, 2017). Some technology providers claim that mayor players using correctly their technology are reducing the development lead time by 20-50 per cent (Papahristou and Bilalis, 2016). Apart from these cost-reducing benefits, the use of 3D virtual prototypes also allows designers to freely and easily experiment with different concept ideas, a variety of fabrics and patterns before the physical good is produced (Papachristou and Bilalis, 2015), thus helping designers enhance their creativity (Reilly, 2014). In addition to the application in the prototyping phase, the 3D printing technology has some other interesting advantages concerning final product customization as it enables small quantities of customised goods to be produced at relatively low costs (Vanderploeg *et al.*, 2017; Parker, 2016).

3D digital technologies are used in some companies operating in this industry (Vanderploeg *et al.*, 2017) – both in clothing and footwear, and overall by manufacturing-focused firms with examples such as Nike or New Balance (Fitzgerald, 2013) leading its adoption. Nevertheless, there are still a small number of fashion companies using them in a successful way (Jefferson *et al.*, 2012); and the use of 3D virtual prototypes and 3D printed prototypes by fashion designers as their primary and unique means of work may still be seen as a science fiction scenario (Papahristou and Bilalis, 2016). Specific 3D software skills are required, and acquiring them can be a very slow and tedious process, that is why it is still difficult for fashion designers with traditional fashion skills to engage in 3D design without the help of digital specialists (Reilly, 2014). To turn this situation around and

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achieve the status it has in other industries, 3D technology still needs technical advancements for which it is important that software companies, the fashion industry and researchers continue to cooperate (Papahristou and Bilalis, 2016; Reilly, 2014).

### 2.3 Contribution

As we have realized in the literature review, there is little documentation on the business practical perspective. In this sense, although a few authors have explained some of the benefits resulting from the use of this technology as a tool for designing and prototyping stages; as far as we are concerned, no one has treated the use of this technology in a more holistic way, analysing how it can impact in every step of the company value chain identifying the benefits in each of the phases from the concept to the customer.

We have also seen that there is a lack of empirical research focused on how fashion designers are empowered with this technology in order to explore new creative scenarios (Reilly, 2014). According to Vanderploeg *et al.* (2017), there is need in the literature of case studies explaining the individual experiences of designers or fashion companies using this technology in their natural business environment.

In this sense, our purpose with this paper is to enlarge the lack of literature in this specific topic by providing a case study that describes the real experience of a creative fashion designer using 3D digital technology with the collaboration of a software company. From this experience we aim to extract benefits of using this technology along the process from the creation to the customer (*RQ1*), as well as the challenges ahead for both software and fashion firms related to the implementation of this technology in a more generalised way (*RQ2*).

## 3. Methodology

We perform in this paper a qualitative research in the form of a case study. In order to do so, we have adopted the case study methodology considerations (Yin, 1994; Miles and Huberman, 1994). The case study is a research methodology widely used and recommended to study phenomena that take place in rich contexts where there are always many variables to consider in comparison to the number of observations made.

Accordingly, considering the novelty of this area of research and following the recommendations for future research of other authors such as Vanderploeg *et al.* (2017), we decided to focus on collecting qualitative data of a real case study that took place in 2014. It can therefore be classified as a retrospective case study in which the events and activities under study have already occurred, and the outcomes of these events and activities are known (Yin, 1994).

The process we followed consisted of different stages. First, due to the personal involvement of one of the authors in the software company, we chose the innovation experience around which we wanted to make the case study research. We took advantage of the scarce academic research conducted by other authors on the same topic and we soon realised that the case study chosen was very interesting and fitted perfectly in the gaps and questions found in the literature. Then, due to the tight contact with both companies, the internal and external documentation generated when the experience took place was accessible to the authors at any time. Furthermore, semi-structured interviews were conducted to the main actors involved in the experience in order to clarify some aspects of the experience that were not clear as well as to know details of the way things really happened. Finally, the findings were listed and contrasted with the main ideas found in the literature review.

## 4. Case study: “A footwear collection 100 per cent digitally conceived”

### 4.1 Context of the case study

This case study is framed in the context of the activity conducted by the FashionLab of Dassault Systèmes[5], a 3D digital innovation hub that was launched in 2011 with the aim

and spirit of bringing 3D technology to the designers' and artists' communities by providing them with the tools and services that will help bring their ideas to life using 3D virtual technology. Since its birth, several innovation experiences have been developed with different partners; but for this paper we are going to focus on one of the projects conducted with their public partner and main ambassador: the French Haute Couture Designer Julien Fournié[6]. Diverse projects have been developed with him since 2011 around the digital transformation of fashion using 3D and other digital technologies. This case study is just one of them and it took place in 2014.

The inception of this specific experience was motivated by the FashionLab who proposed Julien Fournié the possibility of exploring together how 3D technology could help him in the design and development phase until the creation of the virtual prototype of a footwear collection. After thinking it through, he agreed to conduct this innovation experience but with the condition of "reaching the end" of the process until the footwear collection is produced and showcased in the upcoming fashion show, taking place in Paris in July 2014. After having worked in the past as the Creative Director of a footwear brand, he already knew that at that moment it was almost impossible to follow the traditional model – with a common full process lead time of around eight months, so he was interested in experiencing how this technology could help them shorten the process.

Therefore, they set together the objective of the project that was to conduct a 100 per cent digitally conceived footwear collection that would be pre-launched in a public event in Los Angeles with a pop-up store in front of a fashion audience (designers, fashion bloggers, journalists and clients) letting them experience first-hand a physical demonstration of the 3D digital transformation of a footwear collection. After that, the physical products would be officially presented during the fashion show in July.

#### 4.2 Description of the experience

Before starting the project, they worked together on identifying the different elements needed for the experience. They had to decide the technologies they were going to use – both software and hardware – as well as the manufacturer who was going to do the final footwear production. Once they decided all the elements, they set to work on the footwear collection.

*Design.* The first step was to transfer the mental drafts and to develop the ideas the designer had already in his mind into 3D. For doing so, they decided to use another external 3D design software that was specifically conceived for designing footwear. The collection was going to be composed by four different styles: a sneaker, a derby, a ballerina and a heeled sandal. So, as he already had the designs in his mind, it took him just few hours to sketch in 3D with the software the four models using a big graphic tablet; first, he designed the last[7] and then, the four shoes. For this initial step, he did not need a lot of external help thanks to both his background as footwear designer and the low complexity of the 3D sketching module of the software used. Like in any creation process, even though he had the ideas very clear in his mind, as he was designing in 3D he made some important changes to the design, which could be considered as a fast "pre-prototyping phase" due to the high degree of details he modified on the go and the kind of aesthetic decisions he made by only working virtually with the sketch in 3D. He was very aware that working with traditional 2D sketches, this would have never been possible so early in the process.

The second part of the design phase was the 3D industrial design[8] of the shoes. This was done with the help of an expert in the software they were using, as they had no time to train the designer to do it for himself (they would have needed a lot of time and effort to do that and some engineering skills were needed). However, this step was imperative in order to have the 3D digital asset, the exactly "virtual twins" of the shoes, so they could then be used along the chain up to the retail phase in front of the customer. Furthermore, this 3D

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industrial design of the shoes was the one permitting afterwards to do the 3D printing for the prototyping phase.

*Product development (prototyping).* In order to validate definitively the design and aesthetic details of the shoes before producing them, it was important for him to have an almost-real physical prototype in order to see it in a real space and be able to “look and feel” the final design directly with his hands[9]. Therefore, once they finished the 3D industrial design with the expert, they sent the files to a technology partner specialized in 3D printing[10]. Even though the designer was not completely sure of continuing the development of one of the shoes, he decided to print the four models as he thought this step would help him better make the decision.

In less than one week they received the four shoes 3D printed. As soon as the designer had the four 3D prototypes in his hands, he started to make decisions. First, he realized that finally, he was not going to produce the sneaker; he would keep the 3D design and the 3D printed prototype as part of the collection to show it in the pop-up store but the final product was not going to be produced for the moment. Regarding the other three ones, he decided to make some modifications in the sneaker and the heeled sandal. Therefore, the 3D industrial models of the shoes were modified following the designer instructions. Then, the new 3D virtual prototypes of the shoes were approved by Julien Fournié to go on production.

*Manufacturing.* The manufacturer received the 3D files with the industrial designs of the three shoes he had to produce together with the 3D printed prototypes. This helped the manufacturer see exactly how the final shoe was the designer was expecting. There was no margin for errors and the shoes should meet all the details and design specifications of Julien. After a conversation with the manufacturer they decided to first produce only one pair of each model as a final real prototype, and one month later the designer received the shoes in order to validate the result. After analysing the final prototype he decided not to continue with the production of the ballerina, and he approved the other two shoes, which would be finally worn by the models in his fashion show.

*Retail (pop-up store).* The pop-up store was installed as part of a public relationship event in Los Angeles aimed at pre-launching the first footwear capsule collection of Julien Fournié. Due to the small size of Julien’s business, he had to rely on wholesale channel selling his ready to wear line in luxury department stores. However, he had always loved to have his own space to sell his collections, so the idea was to show how it could be like the store of the future for a business like his by leveraging new technologies and especially 3D digital technology. Therefore, in a rather limited space he was able to show his collection fully digitally conceived, letting the customer experience and interact with it in a numerous different ways, both physical and virtual. Customers could touch and feel the real manufactured shoes of the collection and also interact with the 3D printed ones; they could also personalise their own shoes in 3D, modifying the colours and changing fabrics in a tablet; or explore the collection with all its variants in a digital wall thanks to the 3D digital data coming from the design phase. They wanted to create a futuristic store environment in which virtual and physical elements merged in order to provide customers with lasting emotional experiences.

To conclude, the whole experience described in the case study shows a real example of how a fashion designer, belonging to the traditional and exclusive sphere of luxury and haute couture, could experience in his own business the benefits and future possibilities of using 3D technology from the very beginning of the product creation up to the moment in which the product is presented in front of the customer in the store. In words of the director of the FashionLab: “We used 3D at every step of the creative process: from the designer’s talent to the consumer experience. This example of a shoe collection shows our vision for the future of fashion in general. Our ambition is to transform this case created around the footwear industry and to adapt it to the fashion world, luxury sub-segments like watches, jewellery, clothing, accessories or leather goods [...]”.

## 5. Findings and discussion

From the analysis of the case and following the two research questions, we extract some findings that we aim to discuss at this point.

### 5.1 *Benefits along the process (RQ1)*

Several benefits have been identified along the value chain followed in the case, from design to retail. However, as we have seen in the case, the technology was not directly used in all the phases, being for instance the manufacturing phase the less impacted by its utilisation.

*Design phase.* The first benefit we drew from the case study is the enhancement of creativity thanks to 3D design technology that expands the boundaries of restricted traditional design methods, giving more freedom to the designer. Like we saw in the case, Julien Fournié was able to really capture in 3D the design images he had in his mind of the shoes without the 2D limitations or constraints. As Reilly (2014) also pointed out, this technology provided Julien Fournié with a new and more open creative scenario. Second, another benefit is the possibility of keeping track of every change made to the 3D design being able to go backwards very easily, as well as keeping every design in a digital archive that can be “rescued” at any time or used as carryovers for future collections. Finally, important product decisions concerning design and aesthetic details were made early in the process in a step that we called in the case “3D virtual pre-prototyping” phase and which is referred directly as 3D virtual prototyping by other authors in the topic (Cepolina, 2011; Papahristou and Bilalis, 2016; Jefferson *et al.*, 2012). Without 3D technology, these decisions would have been made afterwards, once Julien Fournié had received the physical real prototypes from the manufacturer.

*Product development phase.* After the analysis of the experience, we can confirm and agree the main benefits shared by the authors cited above in the theoretical background (Papahristou and Bilalis, 2016; Choi, 2015; Cepolina, 2011; Vilumsone and Dāboliņa, 2012, Vanderploeg *et al.*, 2017). On the one hand, the product development phase was shortened as the use of 3D digital technology (3D design and 3D printing) could speed up the prototyping phase by eliminating the iterations around product samples. So finally the short times they had when they started were successfully achieved being reduced the development process from eight to two months. On the other hand, development costs were saved, being the prototyping phase the most expensive part of product and collections development. As a result, thanks to 3D digital technology, Julien Fournié was able to reduce the investment needed for this phase, an important barrier he found for launching a luxury footwear capsule collection for the first time.

*Manufacturing phase.* Although the production of the real shoes was done following the traditional manufacturing process, what we can extract from the case is that – as suggested also by Papahristou and Bilalis (2016) – the use of 3D technology in the previous phases of the process helped Julien Fournié to better communicate the final design to the supplier. In addition, by sending to the supplier both the 3D files and the 3D printed prototypes, he could reduce the possible manufacturing errors related to the original design.

*Retail phase.* On the one hand, customers’ experience and service in the store were improved, letting them for instance interact with the product in its initial phase of design or see the collection in 3D thanks to virtual and augmented reality experiences. On the other hand, designers can show in a very realistic way the full collection with all the variants in a much reduced space thanks to 3D rendering and visualisation. In the case study, Julien Fournié was able to show virtually in a very realistic way the whole capsule collection composed by four different models and all their colour variants, from which he only had physically produced three of them (Figure 1).

### 5.2 Challenges ahead for both companies (RQ2)

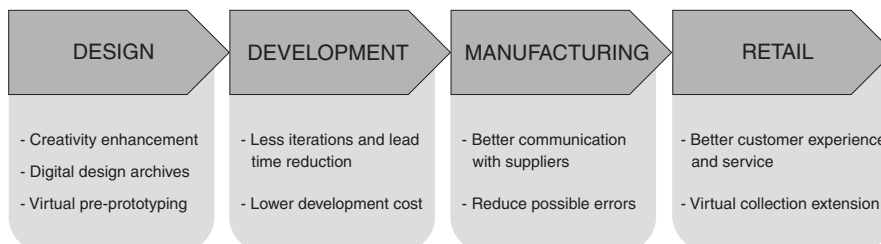
Although the experience described in the case shows the real possibility of using 3D technology, it is evident that huge efforts are still needed until a full adoption is achieved in this industry.

*Fashion companies.* As also mentioned by other authors (e.g.: Jefferson *et al.*, 2012; Reilly, 2014; Papahristou and Bilalis, 2016) and as we have seen in the case study, technical skills and knowledge are needed to work with 3D software. Creative designers without these skills would need to learn how to use this technology in order to be able to do everything on their own. For instance, in the case the designer made the sketches in 3D for the creative design but for the 3D industrial design they needed the skills and support of an expert. Furthermore, to engage in a transformation like this with the use of digital technologies, there should be a special interest and willing coming from the fashion firm or the designer conducting the technology adoption. Therefore, we can extract from here that fashion firms should work first on a digital transformation culture, so everyone in the company, but especially – as we saw in this case – creative designers and team members working around the development process, needs to be somehow excited about the idea of using 3D technology, and so believe that technology is not at odds with craftsmanship and artistic vision.

*Software companies.* Concerning the other side of the equation, there are also some challenges related to the technological firm developing the tools that can be perceived from the case study. On the one hand, these companies need to work on simplifying 3D digital solutions in order to democratise their use among different audiences that have neither the technical skills needed nor the amount of time required to learn and assimilate how to use them. And, on the other hand, there is also a need to adapt the 3D technology to the specificities of each industry providing the functionalities needed for each kind of product category. In the case study we see that they opted to use a partner's 3D software that was conceived specifically for footwear with the insights coming from the industry (Figure 2).

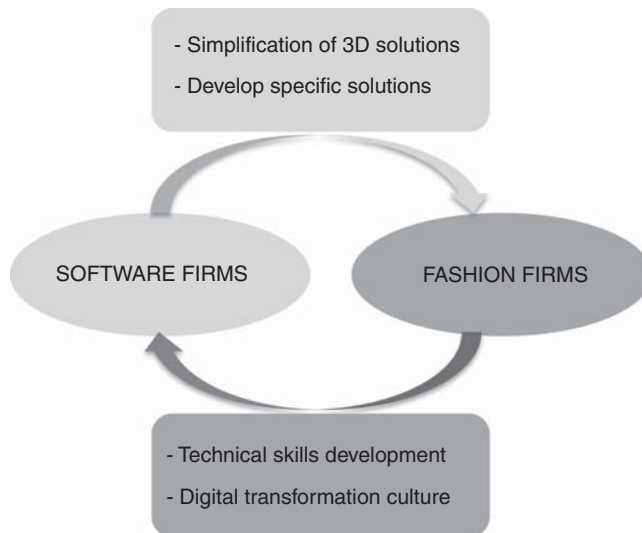
## 6. Conclusions and implications

In this paper we focus on one of the digital technologies transforming the way fashion products are conceived and developed, which is 3D digital technology. However, despite the growing interest the fashion industry is showing in the use of this technology, we have realised that academic research is still scarce, especially in the form of empirical case studies. With our case study, we have shown how a creative haute couture fashion designer has used 3D digital technology with the collaboration of a software company, and we have identified specific benefits along the value chain from concept (creative design phase) to consumer (retail phase) as well as some challenges ahead for both types of companies (fashion companies and software or technology firms). Moreover, apart from the benefits and challenges drawn, in the case study there are some differential elements that



**Figure 1.**  
Benefits along  
the process





**Figure 2.**  
Challenges ahead for  
both companies

enhance its research value among the scarce literature on the topic. First, as already mentioned, it showcases the experience of a creative fashion designer owner of an haute couture brand, which belongs to a luxury high segment where technology is not so widespread due to the cultural barriers related to the product and thus research is scarce (Parker, 2016). Second, the scope of the experience described in the case study is not limited to the use of 3D technology in the design and product development phases but it shows in a practical way how 3D can be used along the full process up to the marketing and retail phase in front of the customer (Papahristou and Bilalis, 2016). Finally, the case presents a collaborative experience conducted between a fashion company and a 3D software firm in which they seek to “learn by doing” from each other and better understand the specific needs of this industry in order to adapt and improve technology. Hence, we would like to highlight especially this differential element of this case as an interesting practice that could be implemented by fashion firms like a previous step of a digital transformation strategy with which they can take up some of the challenges associated such as breaking cultural barriers or developing technological skills.

### 6.1 Limitations and future research

Although we are fully convinced of the value added by this paper to the little academic research existing on this topic, we are also aware of the existing limitations that may require further research contributions. These limitations might be especially associated with the methodology as we based the results on a single case study and therefore any generalisation of the results needs to be carefully considered.

Thereby, concerning possible further research, we agree with Vanderploeg *et al.* (2017) on the need of more case studies about the individual experience of fashion designers and companies using this technology. Due to the novelty of the topic, empirical research and more specifically case studies can help developing a theoretical framework with the identification of different factors, benefits and results related to the use of digital technologies in fashion. In addition, more research could be conducted around the collaborative scenario we show in the case study and the fact that it could be used as a “pre-digital transformation strategy”.

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**Notes**

1. In this paper we use “3D digital technology” for referring to both 3D design software and 3D printing technology, which are the technologies used in the case study.
2. Software designed for managing the information and data of products and collections along the entire lifecycle from its conception through whole development process.
3. Technically called 3D CAD (Computer-Aided Design) is a software used for developing the 3D representation of an object or body. The result is the 3D model of the object which can be used for conducting virtual simulations or for being printed in 3D.
4. Also known as Additive Manufacturing (AM), it is a technology that builds a three-dimensional object or body formed by layers of material that are successively added until the exact object is created. The object is created from its 3D model previously designed in a 3D CAD software.
5. Dassault Systèmes is a leader company in the software and 3D technology industry, which vision is to help companies create sustainable innovation by transforming the way products are designed, produced and supported, enabling them to deliver excellent consumer experiences.
6. French haute couture designer who, after having worked during a decade for some of the most prestigious luxury fashion houses, decided to found his own eponymous fashion house in 2009. One year later, the *Chambre Syndicale de la Haute Couture* – the governing body of the French Haute Couture industry – admitted him as a guest member in the official calendar of the Paris Haute Couture fashion week, being since then part of the very exclusive list of designers starring this event. More recently, in 2016, he was finally granted the official haute couture status joining in an official and permanent way the closed circle of the Parisian couture.
7. The last is the 3D model with the shape of a real human foot used in footwear manufacturing.
8. It is also called 3D model and it is the mathematical representation of the product. This is the “mechanical/functional” design used later on for manufacturing, and the one made by the designer was the “creative” design, focusing more on aesthetics and superficial design.
9. Obviously the look and feel was not exactly as in real due to the hard materials used for printing the shoe and the impossibility of trying on the shoes.
10. 3D printing technology in that moment (2014) was not as developed as it may be nowadays. It had not yet penetrated the fashion goods market so this experience was quite new. Few 3D printing companies were specialized in this type of products. However, the result was quite good and they had a rather quick time of response.

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